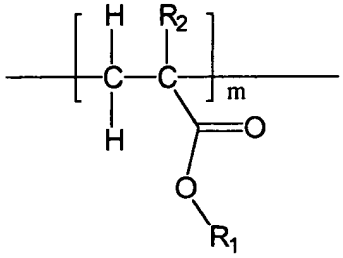
LISTING OF CLAIMS

1. (Previously presented) A method of forming an underlayer of a bi-layer resist film, comprising:

forming a blended material by blending a polymer having an aromatic group and a methacrylate polymer represented by the following chemical formula:



wherein, R_1 is one selected from a group consisting of an aromatic compound, a hydrocarbon of 1 to 5 carbon atoms, an aliphatic hydrocarbon of 1 to 15 carbon atoms, a lactone of 1 to 15 carbon atoms, an ether of 1 to 15 carbon atoms and a carboxylic acid of 1 to 15 carbon atoms, R_2 is a hydrogen or a methyl group, and m is an integer ranging from 10 to 500;

coating a substrate with the blended material; and

irradiating the blended material coated on the substrate with an e-beam to form said underlayer, and wherein the polymer having the aromatic group is a novolac polymer or a naphthalene polymer.

2. (Canceled)

3. (Previously presented) The method according to claim 1, wherein the methacrylate polymer is blended to 20 to 70 wt% of a sum of weights of the novolac and the methacrylate polymers.

4. (Previously presented) The method according to claim 1, wherein the methacrylate polymer is blended to 20 to 70 wt% of a sum of weights of the naphthalene and the methacrylate polymers.

5. (Original) The method according to claim 1, wherein the blended material futher includes:

at least one selected from a group consisting of a thermal acid generator, a cross-linker and a surfactant.

Claims 6-9 (Canceled)

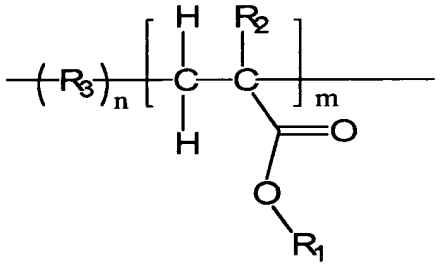
10. (Previously presented) The method according to claim 1, wherein the e-beam has energy of about 0.1 mC/cm^2 to about 100 mC/cm^2.

11. (Original) The method according to claims 1, wherein the coated substrate is irradiated at a temperature of about room temperature to about 100 °C.

12. (Original) The method according to claim 11, wherein the temperature at which the coated substrate is irradiated is adjusted using a hot plate or a halogen lamp.

13. (Previously presented) A method of forming a underlayer of a bi-layer resist film, comprising:

preparing a material including a copolymer having a monomer with an aromatic group and a methacrylate monomer, the copolymer represented by the following chemical formula:



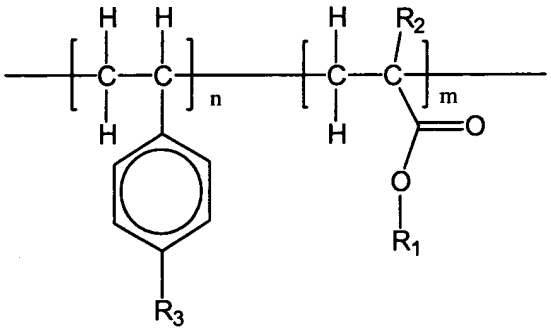
wherein, R_1 is one selected from a group consisting of an aromatic compound, a hydrocarbon of 1 to 5 carbon atoms, an aliphatic hydrocarbon of 1 to 15 carbon atoms, a lactone

of 1 to 15 carbon atoms, an ether of 1 to 15 carbon atoms and a carboxylic acid of 1 to 15 carbon atoms, R_2 is a hydrogen or a methyl group, R_3 is a monomer having an aromatic group, and each of m and n is an integer ranging from 10 to 500;

coating a substrate with the prepared material; and

irradiating the prepared material coated on the substrate with an e-beam to form said underlayer and, wherein the copolymer is a copolymer having styrene and methacrylate monomers.

14. (Previously Presented) The method according to claim 13, wherein the copolymer having the styrene and the methacrylate monomers is represented by the following chemical formula:



wherein, R1 is one selected from a group consisting of an aromatic compound, a hydrocarbon of 1 to 5 carbon atoms, an aliphatic hydrocarbon of 1 to 15 carbon atoms, a lactone of 1 to 15 carbon atoms, an ether of 1 to 15 carbon atoms and a carboxylic acid of 1 to 15 carbon atoms, R2 is a hydrogen or a methyl group, R_3 is one selected from a group consisting of hydrogen, a hydroxyl group, a chlorine and a bromine, and each of m and n is an integer ranging from 10 to 500.

15. (Original) The method according to claim 14, wherein the mole ratio m/(m + n) is about 0.3 to about 0.6.

16. (Original) The method according to claim 13, wherein the material including the copolymer further includes:

at least one selected from a group consisting of a thermal acid generator, a cross-linker and a surfactant.

Claims 17-20 (Canceled)

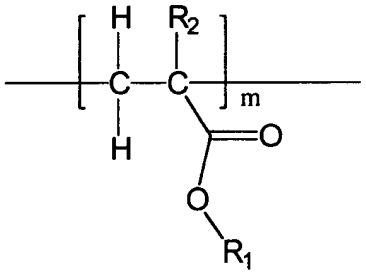
21. (Previously presented) The method according to claim 13, wherein the e-beam has energy of about 0.1 mC/cm^2 to about 100 mC/cm^2.

22. (Original) The method according to claim 13, wherein the irradiation of coated substrate is performed at a temperature of about room temp. to about 100 °C.

23. (Original) The method according to claim 22, wherein the temperature at which the coated substrate is irradiated is adjusted using a hot plate or a halogen lamp.

24. (Previously presented) A method of forming a semiconductor device using a bi-layer resist, comprising:

forming a blended material by blending a polymer having an aromatic group and a methacrylate polymer represented by the following chemical formula:



wherein, R_1 is one selected from a group consisting of an aromatic compound, a hydrocarbon of 1 to 5 carbon atoms, an aliphatic hydrocarbon of 1 to 15 carbon atoms, a lactone of 1 to 15 carbon atoms, an ether of 1 to 15 carbon atoms and a carboxylic acid of 1 to 15 carbon atoms, R_2 is a hydrogen or a methyl group, and m is an integer ranging from 10 to 500;

coating a substrate with the blended material;

forming an underlayer by irradiating the blended material coated on the substrate with an e-beam;

forming a toplayer over the underlayer;

forming a toplayer pattern in the toplayer;

forming an underlayer pattern by etching the underlayer using the toplayer pattern as an etch mask; and

etching the substrate using the underlayer pattern as an etch mask, and wherein the polymer having the aromatic group is a novolac polymer or a naphthalene polymer.

25. (Original) The method of claim 24, further comprising:

performing a first prebake after coating the substrate with the blended material.

26. (Original) The method of claim 25, further comprising:

performing a second prebake after forming a toplayer over the underlayer.

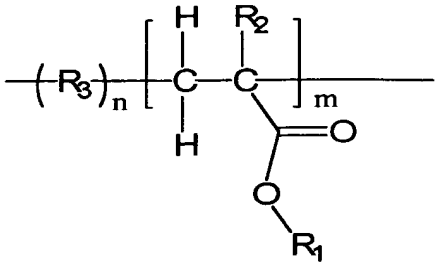
27. (Original) The method of claim 24, further comprising:

removing the toplayer and the underlayer after etching the substrate.

28. (Original) The method of claim 27, wherein the toplayer and the underlayer are removed by ashing.

29. (Previously presented) A method of forming a semiconductor device using a bi-layer resist, comprising:

preparing a material including a copolymer having a monomer with an aromatic group and a methacrylate monomer, the copolymer represented by the following chemical formula:



wherein, R_1 is one selected from a group consisting of an aromatic compound, a hydrocarbon of 1 to 5 carbon atoms, an aliphatic hydrocarbon of 1 to 15 carbon atoms, a lactone of 1 to 15 carbon atoms, an ether of 1 to 15 carbon atoms and a carboxylic acid of 1 to 15 carbon atoms, R_2 is a hydrogen or a methyl group, R_3 is a monomer having an aromatic group, and each of m and n is an integer ranging from 10 to 500;

coating a substrate with the prepared material;

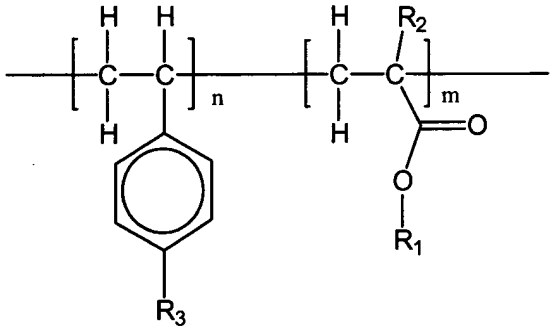
forming an underlayer by irradiating the prepared material coated on the substrate with an e-beam;

forming a toplayer over the underlayer;

forming a toplayer pattern in the toplayer;

forming an underlayer pattern by etching the underlayer using the toplayer pattern as an etch mask; and

etching the substrate using the underlayer pattern as an etch mask and, wherein the copolymer is a copolymer having styrene and methacrylate monomers, the copolymer is represented by the following chemical formula:



wherein, R1 is one selected from a group consisting of an aromatic compound, a hydrocarbon of 1 to 5 carbon atoms, an aliphatic hydrocarbon of 1 to 15 carbon atoms, a lactone of 1 to 15 carbon atoms, an ether of 1 to 15 carbon atoms and a carboxylic acid of 1 to 15 carbon atoms, R2 is a hydrogen or a methyl group, R_3 is one selected from a group consisting of hydrogen, a hydroxyl group, a chlorine and a bromine, and each of m and n is an integer ranging from 10 to 500.

30. (Original) The method of claim 29, further comprising:

performing a first prebake after coating the substrate with the prepared material.

31. (Original) The method of claim 30, further comprising:

performing a second prebake after forming a toplayer over the underlayer.

32. (Original) The method of claim 29, further comprising:

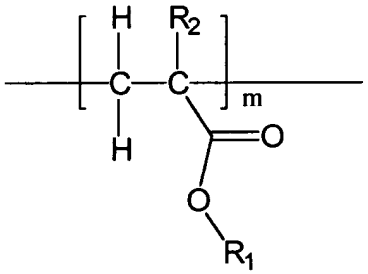
removing the toplayer and the underlayer after etching the substrate.

33. (Original) The method of claim 32, wherein the toplayer and the underlayer are removed by ashing.

34. (Canceled)

35. (Previously presented) A method of forming an underlayer of a bi-layer resist film, comprising:

forming a blended material by blending a polymer having an aromatic group and a methacrylate polymer represented by the following chemical formula:



wherein, R_1 is one selected from a group consisting of an aromatic compound, a hydrocarbon of 1 to 5 carbon atoms, an aliphatic hydrocarbon of 1 to 15 carbon atoms, a lactone of 1 to 15 carbon atoms, an ether of 1 to 15 carbon atoms and a carboxylic acid of 1 to 15 carbon atoms, R_2 is a hydrogen or a methyl group, and m is an integer ranging from 10 to 500;

coating a substrate with the blended material; and

irradiating said blended material on a substrate with an e-beam to cause a cross-linking reaction wherein the methacrylate polymer of the blending material becomes cross-linked, thereby forming said underlayer.

36. (Previously presented) The method of claim 1, wherein the polymer having an aromatic group is a naphthalene polymer.

37. (Previously presented) The method of claim 1, wherein the polymer having an aromatic group is a novolac polymer.